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(54) Valve unit

(57) A fluid power valve unit comprises at least one electromagnetic actuating block (11 and 12) on a valve block (10) which is adapted to be connected with a connection block (14) having fluid power ducts (16 and 17) therein. This connection block (14) has means (33 and 34) for connection with further connection blocks (14) and contains electrical power and/or control conductors therein, and a plug device (20-22) connected with these conductors is arranged in the connection block and effects electrical connection with the further connection blocks (14). Furthermore there are electrical connecting devices (25 and 15) for the connection of the plug device in the connection block (14) with electrical terminals (28) of the at least one actuating block (11 and 12). It is thus possible to dispense with wiring using separate wire elements on the valve unit even in the case of a number of such units being plugged together in rows, the electrical connections also being automatically produced on plugging together. 10

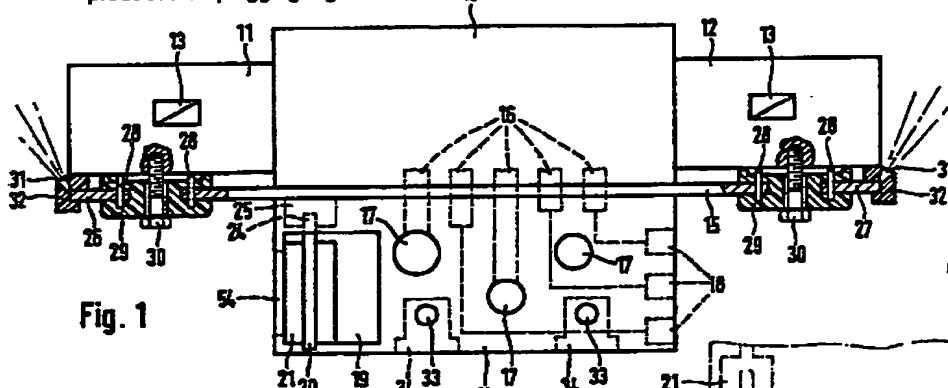


Fig. 1

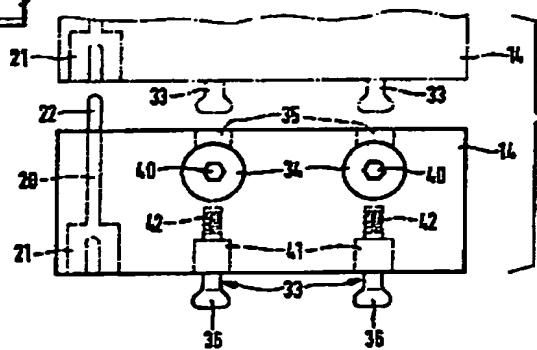


Fig. 2

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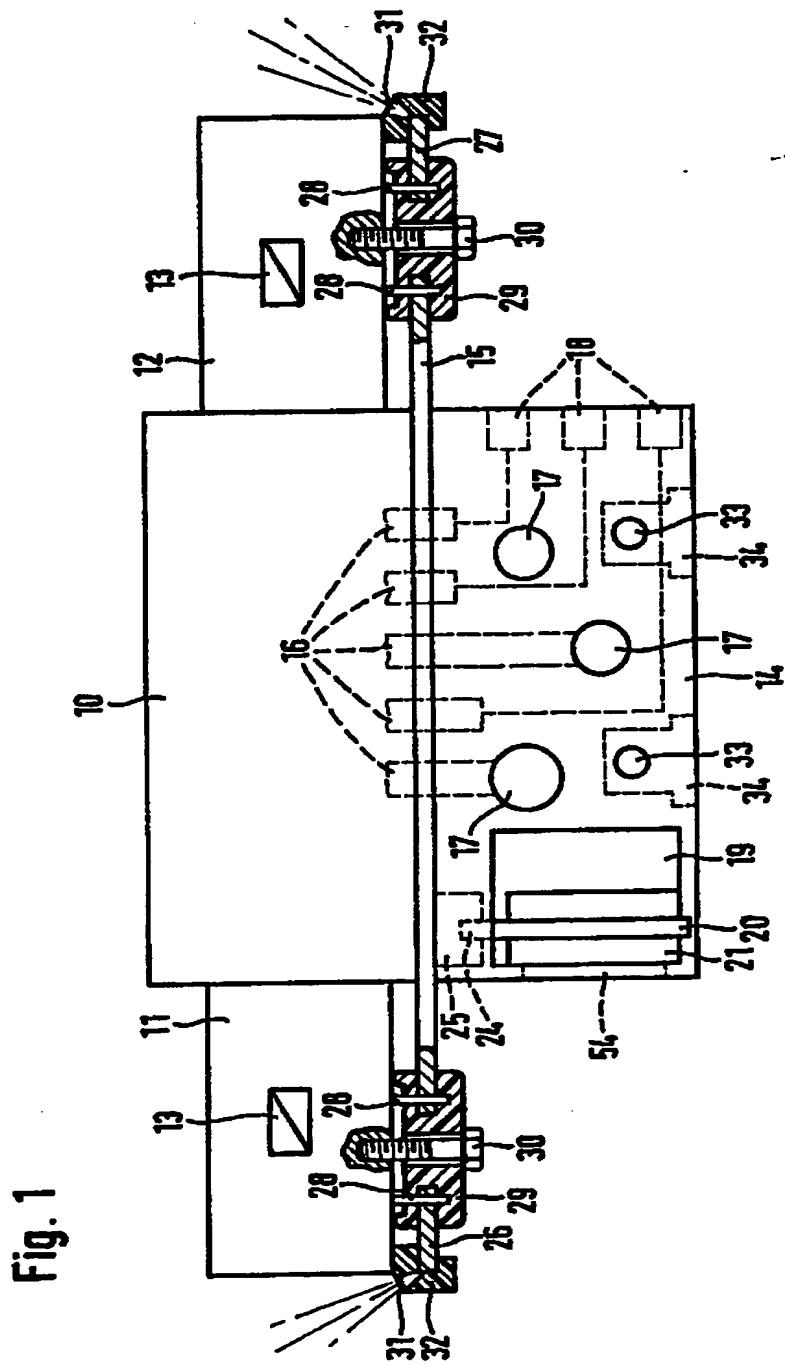
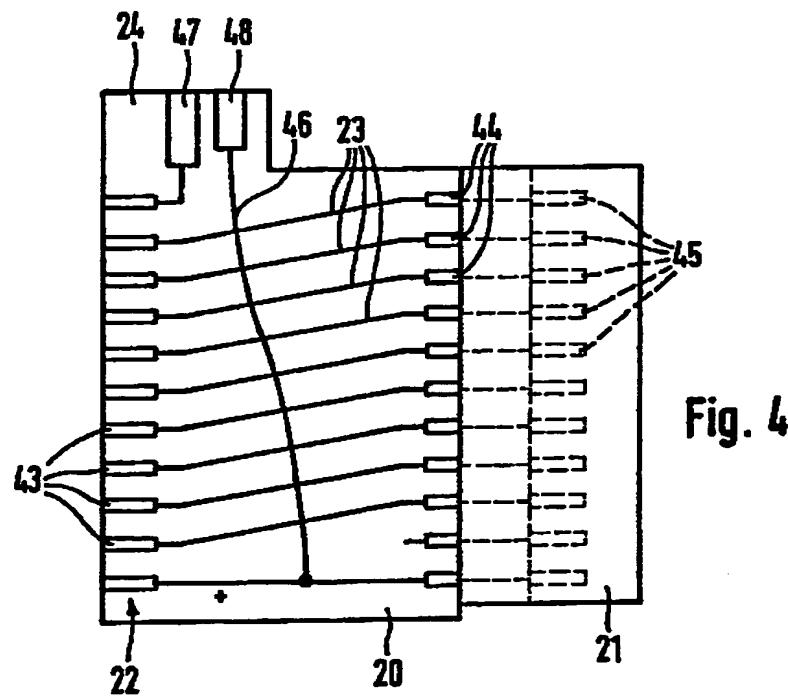
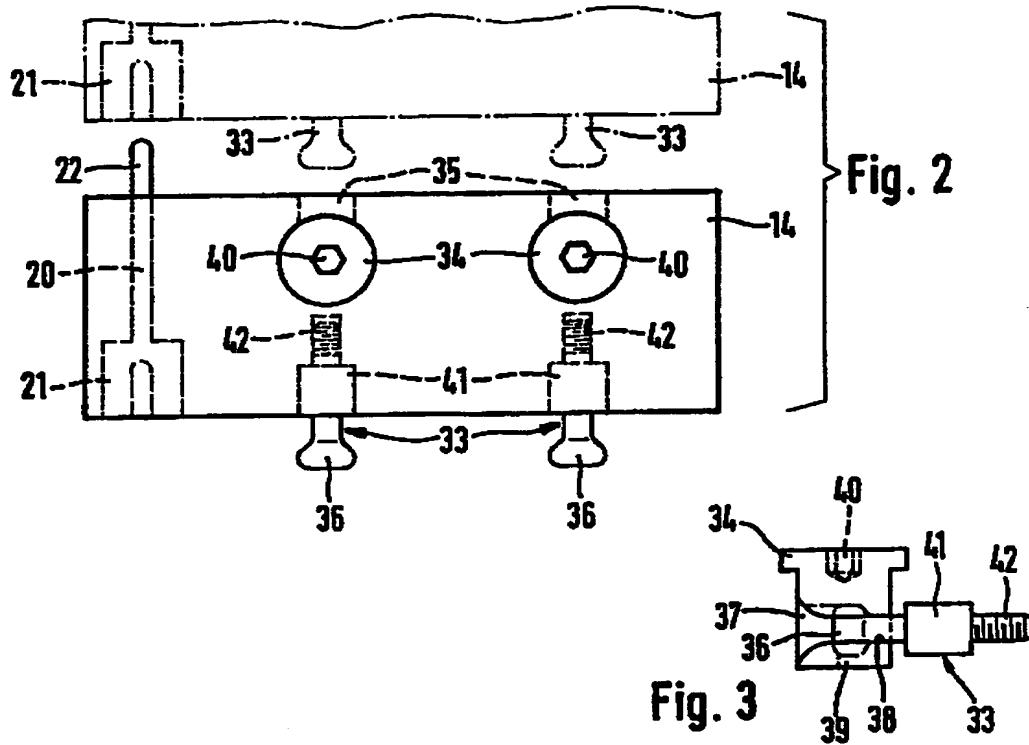


Fig. 1

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3 / 3

Fig. 5

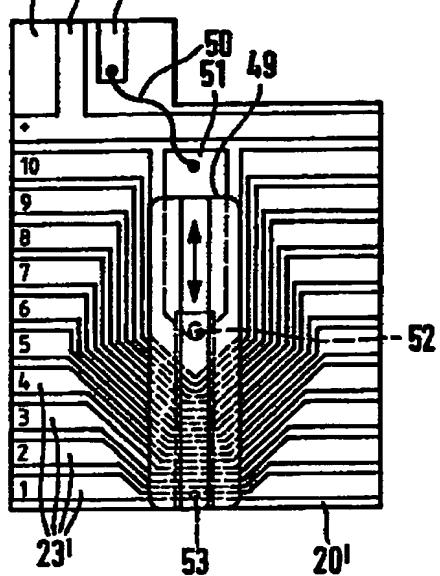


Fig. 6

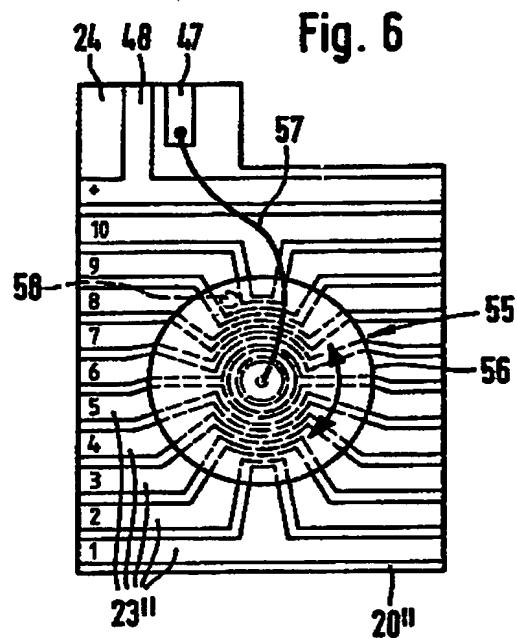
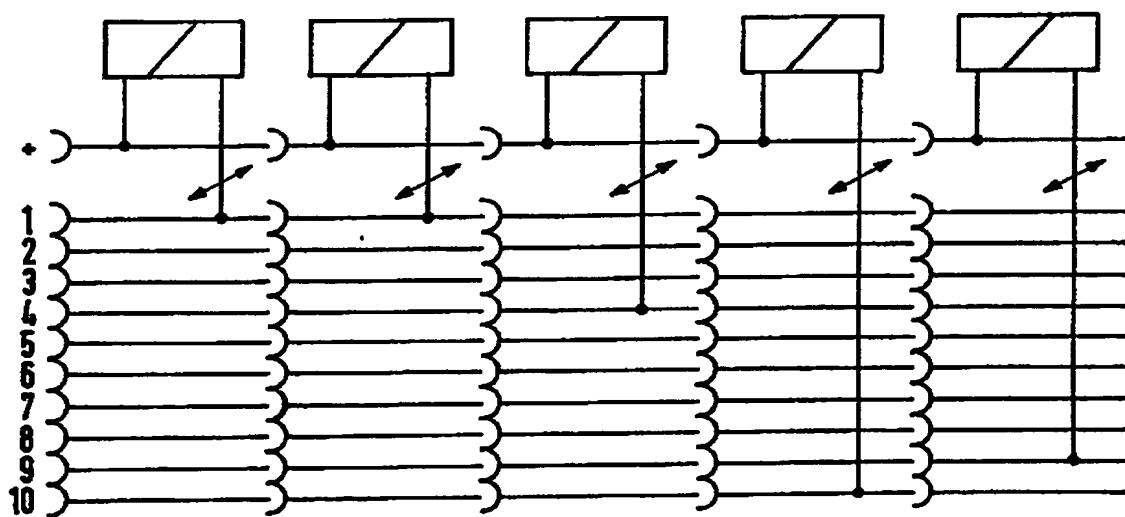


Fig. 7



A Fluid Power Valve Unit

The invention relates to a valve unit and more particularly but not exclusively to a fluid power, that is to say pneumatic or hydraulic power, valve unit comprising a valve block which bears at least one electromagnetic actuating block and is 5 adapted for connection with a connection block having fluid power ducts, said connection block having means for connection with further connection blocks.

Such connection blocks and valve blocks connected therewith are commonly connected together in the form of long rows 10 alongside each other with the connection blocks being connected with each other and at least partly containing the fluid power supply ducts for instance. For actuation of the valve blocks it is necessary for the associated actuating blocks to be provided with electrical connection cables. It is more especially in the 15 case of long rows of such valve blocks where pulse valves for instance may in addition have two respective electromagnetic actuating blocks, that a very elaborate, untidy-looking wiring system comes into being, which makes servicing and fault finding a very time-consuming operation. Later modification of the control 20 wiring for redesigning such an installation is also very complex and slow. A further point is that there is the danger that the electrical wiring arranged more or less loosely on the exterior of

the blocks may be pulled off or otherwise damaged by mechanical contact with relatively moving structures. The replacement of one type of valve by another generally makes necessary a new design for the wiring.

5 One object of the present invention is to devise a valve unit of the initially mentioned type which does not have any externally arranged connection leads.

10 A further object of the invention is to provide such a valve unit such that the attachment of new blocks may be performed with the substantially automatic production of the electrical 15 connections.

In order to achieve these or other objects appearing in the present specification, claims and drawings, a fluid power valve unit is characterized in accordance with the invention in 15 that unit comprises: a valve block which bears at least one electromagnetic actuating block and is adapted for connection with a connection block having fluid power ducts, said connection block having means for connection with further connection blocks, 20 electrical power supply and/or control lines extending in the connection block, plug connection devices connected with these lines arranged on those sides of the connection block which on connection with further connection blocks come into engagement with corresponding sides thereof and electrical connecting means 25 for the lines in the connection block, said electrical connecting means including electrical terminals of the at least one actuating block. There are advantages more especially since on the application of a further connection block, owing to the plug 30 connection means, the electrical conductors are automatically guided into the new connection block without any necessity for a special adaptation of the wiring. The conductors extend within the connection blocks and are thus protected against damage. It is possible to individually determine which of the many conductors introduced into the connection in this manner are to be connected with the associated actuation block. The insertion of the

conductors into the respective connection block is not influenced by this in any way. For this reason it is possible to replace items on such a valve block after completion of manufacture without any wide-ranging alteration of the wiring being needed.

- 5 Further features and developments of the invention are described in the claims.

In accordance with a particularly simple further feature of the invention the conductors, which are more especially in the form of printed wiring are carried on a printed circuit board, in 10 the case of which two opposite side edges carry plug connection devices and/or are designed in the form of plug connection devices. In this manner it is possible to arrange a very large number of conductors exactly in such a manner that they may be easily visually checked, the plugging together with a further 15 connection block or suitable printed circuit boards meaning that the conductors are continued in the further connection block or blocks. Such a printed circuit board is readily produced and may be inserted into the connection block and may if necessary be later replaced after the valve unit has been mounted in the 20 equipment it is designed for.

It is convenient if the one plug connection device is in the form of a multiple male plug connector and the other plug connection device is in the form of a corresponding female plug connector, one of the connectors and more especially the multiple 25 male one projecting out of the connection block. When the connectors are joined together the projecting multiple male connector will fit into the corresponding female connector on the circuit printed circuit board in the next connection block. The multiple male connector may simply be formed by portions of the 30 printed wiring.

By accommodating the printed circuit board in passages through the connection block it is possible to ensure simplicity of insertion and replacement of the printed circuit boards.

The printed circuit board in addition possesses control

connection contact means for the electrical connecting means leading to the actuating block, at least two of the conductors being connected, or being able to be connected, with these control terminals. It is in this manner that it is possible to ensure 5 simple correspondence of the terminals for the respective actuating block with given conductors on the printed circuit board.

In order to make possible the creation of uniform printed circuit boards for all connection blocks the contact means of the 10 plug connection devices are arranged along the lateral edges of the printed circuit board in a juxtaposed manner, and for transmission of the potential of one of the operating voltage poles one of these contact means is connected with the directly opposite contact and with one of the control terminal contact means, whereas the remaining contact means are respectively 15 connected in an offset manner with the opposite contact means, one of the two outer contact means being connected with a second one of the control terminal contact means. This ensures that each of the conductors extending from one printed circuit board to the 20 next is always connected with only one given actuating block, and the order of the contact means, arranged side by side, of the first printed circuit board is in agreement with the order of the valve blocks. This ensures that there is an unambiguous 25 association in a simple manner and in the case of a modification of the terminal conductors being necessary it is only necessary to connect the particular contact means of the first printed circuit board with a new control conductor.

The possibility of providing an even more customized design still using standard, uniform printed circuit boards is 30 possible if the contact means of the plug connecting devices are arranged along the side edges of the printed circuit board in a juxtaposed manner, and the contact means on the one side edge are connected with the correspondingly arranged contact means on the other side edge via the printed wiring, and one of the printed

- conductors is connected with one of the control terminal contact means for transmission of the potential of one power supply pole, while at least a second contact means of the control terminal contact means is able to be connected with one of the remaining printed conductors via a multi-way switch device. This multi-way switch may be in the form of a linear or rotary switch. This makes it possible to provide a simple way to modify the association of the control terminals, even after manufacture is completed, on an actuating block with respect to one of the printed conductors, to interrupt such association or to modify the same. This design also makes it possible to connect a plurality of actuating blocks with the same printed conductor, that is to say to connect them in parallel. For later modification of the association with one of the electrical supply conductors it is preferred to provide an opening in the housing of the connection block for access to the linear or rotary multi-way switch. Given a suitable design of the printed circuit board, this opening in the housing may also be used for later replacement of printed circuit boards.
- In accordance with a particularly advantageous design the electrical connecting means for use with the electrical terminals of the actuating block are also in the form of a printed circuit board. This means that it is possible to dispense with all separate conductors. This printed circuit board is arranged between the valve block and the connection block and has a part projecting past as far as the terminal contact means of the at least one actuating block. If there are two opposite actuating blocks there are then two projecting parts. This arrangement ensures that the printed circuit board is simultaneously fixed to the connection block at the time of assembly of the valve block. Connecting conductors, preferably designed in the form of printed conductors on the printed circuit board, are connected with a plug connection device projecting towards the connection block, the plug connection device inserted into a corresponding hole in the

connection block being able to be pluggingly connected with the control terminal contact means of the other printed circuit board. The result is that the necessary terminals are automatically plugged or slipped on by slipping this printed circuit board onto 5 the connection block so that the two printed circuit boards are able to be pluggingly connected together in a configuration in which they are perpendicular to each other.

It is advantageous if the projecting part has a plug connection device which may be connected with plug connection 10 devices on the actuating block so that on plugging or slipping on the valve block having at least one actuating block on the connection block all the electrical connections are produced at the same time.

The plug connection devices on the actuating block are 15 preferably in the form of plug contact means fitting into the printed circuit board and the plug connection devices on the printed circuit board are preferably in the form of suitably designed contact openings so that on the whole the result is a very simple and moderately priced plug connection device 20 arrangement.

The plug connection devices on the printed circuit board are preferably surrounded by a sealing element, preferably made of elastomeric material able to be inserted into the printed circuit board in order to protect the said contact means against moisture, 25 effects of the environment and damage by touching.

In order to provide for rapid and reliable assembly of the connection blocks with each other, of the two opposite sides, of each connection block, which are able to be engaged with corresponding sides of further connection blocks, the one side is 30 provided with projecting retainer elements having a retainer head and the other side has openings to receive corresponding retainer elements of a further connection block, the openings coming to an end at rotary elements set in the connection block, such rotary elements being provided with a rotary wedge or key for fixing an

inserted retainer head on rotation of the rotary element. For fixing in place the connection blocks designed in this manner only have to be plugged together and then only fixed in relation to each other by twisting the rotary elements. It is thus possible

5 to dispense with fastening screws, screws having been frequently employed with different lengths for arrangements of different lengths of connection blocks and such screws have to be suitably stored and made available. In the novel arrangement herein it is only necessary to provide, on the one hand, retainer elements

10 which are of identical design and, on the other hand, identically produced rotary elements, which may readily be inserted in or slipped on the connection blocks or pre-assembled in place. Such a connection between the blocks is something which is significant in its own right and independent of the rest of the design of the

15 conductor system.

The retainer elements are preferably designed to be screwed into the connection block, whereas the rotary elements are able to be inserted into suitable recesses in the connection block, which are arranged so as to be perpendicular to the

20 openings, the outer side of the inserted rotary elements being generally flush with the outer face of the connection block so that there is a satisfactory abutting action between the two.

Working embodiments of the invention will now be described in more detail with reference to the drawing and the ensuing

25 account thereof.

Figure 1 is a lateral elevation of
an embodiment of the
invention in the form of a
complete valve unit with
two actuating blocks.

Figure 2 is a view from below of a
connection block.

Figure 3 shows a retainer element
inserted into a rotary

element.

Figure 4 shows a first working embodiment of a printed circuit board adapted to be inserted into a connection block with terminals, which have a fixed electrical association with each other.

Figure 5 shows a second working embodiment of the invention in the form such a printed circuit board with a slide switch for modifying the electrical association.

Figure 6 depicts a third working embodiment of the invention in the form of such a printed circuit board with a rotary switch for modifying the electrical association.

Figure 7 is a diagrammatic circuit of printed circuit boards of actuating blocks connected with printed circuit boards in accordance with figure 5 or figure 6.

The valve unit illustrated in figure 1 is made up of a fluid power, i. e. pneumatic or hydraulic, valve block 10 with electromagnetic actuating blocks 11 and 12 mounted on the two opposite end faces of the valve block 10. In a conventional manner the blocks contain a diagrammatically indicated

electromagnet winding 13 serving for the operation of a valve member, not shown, arranged in the valve block 10. In the case of the illustrated arrangement with two actuating blocks 11 and 12 it may for instance be a question of a pulse valve. It is naturally 5 possible however to use other types of valve in the present case, as for instance valves only having one actuating block only.

The valve block 10 is mounted and secured to a connection block 14, there being a printed circuit board 15 arranged between the two of them and which will be described in more detail infra. 10 All the necessary valve conductors 16 or ducts, of which five are shown diagrammatically in broken lines, extend from the connection block 14 to the valve block 10. Such conductors may amount to conventional compressed air lines or ducts, power lines, venting lines and control lines. Accordingly the printed circuit board 15 15 has openings corresponding thereto, which are sealed off. Some of these valve conductors 16 open into transverse ducts 17 of the connection block 14, which on assembly together of a plurality of connection blocks are aligned with each other. It is in this manner that it is possible, for instance, for the supply of 20 compressed air or possibly the venting of air, to take place in a uniform manner. The remaining conductors open at terminals 18 at the end side of the connection block 14, which for instance may be connected with power conductors leading to loads. The fitting together of valve blocks with such connection blocks may - with 25 the exception of the printed circuit board 15 - be conventional so that no detailed description is provided of the arrangement of fluid power conductor means, more especially because such arrangement is not in any way critical for the present invention.

In a further through passage 19 which is also transverse 30 and is of larger size, a printed circuit board 20 is arranged having a female plug connector 21 so as to be aligned with the longitudinal direction of the said through passage 19 and which will be described in more detail later in connection with figures 4 through 6. On assembly the connection blocks 14 to form a row

running perpendicularly to the plane of figure 1 each end edge part, designed in the form of a multiple plug connector 22, of the printed circuit board 20 extend in a connection block 14 in to the female plug connector 21 of the next connection block so that the 5 printed wiring 23 on the printed circuit boards 20 is continued into the further connection blocks, i. e. connected therewith.

The upper end part of the printed circuit board 20 is designed to constitute a male plug connector 24 and in the assembled state, see figure 1, fits into a female plug connector 10 25 on the lower side of the other printed circuit board 15, which is arranged to be normal to the printed circuit board 20. This leads to the production of connections between the printed wiring 23 and printed wiring located on the printed circuit board 15. This printed wiring, which is not illustrated, on the printed 15 circuit board 15 extends from the female plug connector 25 to both sides into the two end parts 26 and 27 projecting past the connection block 14, of the printed circuit board 15, which generally speaking fits under the actuating blocks 11 and 12.

Connection contact pins 28 extend from each of the two 20 actuating blocks 11 and 12 downwards so that in the assembled state as shown in figure 1 the pins fit into suitable contact openings in the printed circuit board 15. These contact openings, which are not shown in detail, are connected with the printed circuit board so that the connection contact pins 28 are able to 25 be connected via the female plug connector 25 with the wiring 23 on the printed circuit board 20 or are in fact connected therewith.

In order to protect the plug connection device consisting 30 of the terminal contact pins 28 and the corresponding contact openings in the printed circuit board 15 against the penetration of moisture, liquid and dirt etc. and also against mechanical damage and to prevent the parts being touched, the part in question is in each case covered over by an elastomeric sealing element 29. This sealing element 29, which is in the form of a

molding, is adapted to be plugged into a suitable opening in the printed circuit board 15 and serves at the same time as an elastic spacer to maintain the required distance from the actuating block 11. As a matter of principle it is possible for this sealing

5 element 29 to be injected in place or it may be made of another insulating material. A retainer screw 30 extends through this sealing element 29 for securing the printed circuit board 15 on the actuating block 11 or, respectively, 12.

At the outer end parts of the printed circuit board 15
10 LED's 31 are arranged, which are also connected, in a manner not shown, with the wiring on the printed circuit board 15 so that the respective switching state of the actuating blocks 11 and 12 and the presence of a control voltage for the same is indicated. The LED's 31 are also surrounded by a protective sealing element 32.

15 In a simplified form of the valve unit the valve block 10 may naturally have only one actuating block if desired. One of the projecting end parts 26 and, respectively, 27 of the printed circuit board 15 may then be omitted, i. e. the printed circuit board does not have to project at both ends. The arrangement
20 shown of the male plug contact means and the female connectors of the plug connection devices described may naturally also be reversed so that for instance the printed circuit board 15 may bear the connection terminal contact pins 28, which will then fit into corresponding contact openings in the actuating blocks.

25 In order to attach a plurality of connection blocks 14 together in a row use is made of retainer elements 33 and rotary elements 34 adapted to cooperate therewith and which will be explained in more detail with reference to figures 2 and 3. In figure 2 the connection block 14 will be seen from below. At one
30 side part the rotary elements 34, which are generally cylindrical in design, are fitted in a rotating manner in suitable openings in the connection block 14. In figure 2 it is a question of two rotary elements 34, but the number thereof is naturally not critical. Openings 35 extend from the openings for receiving the

rotary elements 34 so as to be perpendicular to them and directed towards one side of the connection block 14, for receiving the respective retainer elements 33 of the next connection block 14 which is to be attached. On plugging such a further connection
5 block 14 in place the retainer heads 36, which are made with a larger diameter, engage the free ends of the retainer elements 33, extending out of the connection block 14, and extend into these openings 35 and into the rotary elements 34. The rotary elements 34 have a slot 38 which extends from a suitable opening 37 and
10 tapers in the circumferential direction. The slot 38 is formed by a rotary wedge 39. Since this rotary wedge 39 or key increases radially in diameter when such turning motion takes place, the respective inserted retainer head 36 is drawn in during the rotation and is locked by the tapering slot 38 so that a secure
15 holding action is ensured. In order to ensure powerful torque transmission the rotary elements 34 have a hex socket 40 in their outwardly directed surface in order to receive a male hex wrench. It is naturally possible to use other wrenches together with other means for engagement thereof.

20 The retainer elements 33 are designed to be screwed into suitable openings of the connection block 34 opposite to the openings 35, the middle part with the larger diameter being designed in the form of a centering part 41, which is adjoined by a screw part 42. The centering part 41 is, in the screwed in state, aligned with the outer face of the connection block 14.
25 The same applies for the outwardly directed surface of the rotary element 34, which is also aligned with the outer face of the connection block 14.

In figure 2 the connection block 14 will be seen in a
30 state shortly before assembly with a further connection block shown in broken lines. In this view it will also be seen that the end edge part, designed as a multiple plug connector 22, of the printed circuit board 20 projects past the connection block 14 and thus is able to fit into the female plug connector 21 set in the

next connection block. As a matter of principle this arrangement would be able to be reversed without an difficulty.

The printed circuit board shown in figure 4 has - as indicated previously - a female plug connector 21 on one end edge part and at the opposite end edge part is in the form of a male multiple plug connector 22, which is able to be connected with a corresponding, female connector 21 on a further identical printed circuit board 20. For this purpose this male multiple plug connector 22 has a row of adjacently placed contact faces 43, also in the form of printed wiring, while at the opposite end edge part there is a corresponding number of contact faces 44 in the same arrangement. The contact faces 44 are in this respect connected with corresponding contact faces 45 in the female plug connector 21, which naturally may also be designed in the form of contact springs, contact tags or the like.

The lowermost contact face 43 is connected with the lowermost contact face 44 via a wire of the printed wiring 23. This part of the printed wiring 23 is connected with the potential of a terminal of the supply voltage, i. e. the power supply. Furthermore this lowermost printed wiring 23 is connected via a connecting wire 46 with a contact face 48 of the upper end part, designed in the form of a male plug connector 24, of the printed circuit board 20. The uppermost of the contact faces 43 is connected with a further contact face 47 of the male plug connector 24. The other contact faces 23 are so connected via the further printed wiring 23 with the opposite contact faces that in each case there is an offset by one contact face in an upward direction. This means that starting with a first printed circuit board 20 the uppermost contact face 43 is connected with the first actuating block, while the contact faces 43 located thereunder are connected with the second, third, fourth and so on actuating block etc. of the following valve units. This ensures that there is a definite association between the contact faces 43 of the first printed circuit board 20 with the actuating blocks of the

overall arrangement and the contact faces 43 of this first printed circuit board 20 may be suitably connected. Further terminals and connection wiring are not needed.

The further working embodiment of the invention shown in figure 5 as an example of such a printed circuit board 20' has a vertically moving slide switch 49. The wiring 23' extends in this case directly between opposite contact faces, which are not shown in this case in order to simplify the figure. These contact faces, just like the female plug connector 21, may be designed as in figure 4. In the case of this form of the invention the uppermost printed wiring 23', which receives the positive potential of the power supply, is connected with the contact face 48 of the male plug connector 24. The other contact face 47 of this male plug connector 24 is connected via a connecting wire 50 with a contact face 51, which in every setting of the switch is connected via a wiper contact 52 with the slide switch 49. A further wiper contact 53 connected in a conducting manner with the wiper contact 52 runs over the middle part of the printed wiring 23' when the slide switch is moved vertically 49. At this position the wiring is arranged in a compressed manner, that is to say the wires are placed close together. As a result every actuating block 11 and, respectively, 12 of a valve unit may be connected subsequently by operation of the slide switch 49 with one of the wires of the printed wiring 23', that is to say connected with any one of a number of control lines as may be desired. This makes possible subsequent modification of the wiring arrangement and of the conductor connections. For access to the slide switch 49, which is located on the printed circuit board 20' in the through passage 19 in the interior of the connection block 14, there is a suitable recess 54 on the respective end of the connection block 14. It is by way of this opening 54 that, given a suitable design of the arrangement, it is possible to replace the printed circuit boards without the valve unit having to be taken to pieces.

The working embodiment of the invention shown in figure 6 in the form of a printed circuit board 20" is designed in a manner similar to that of figure 5 and is also shown in a simplified manner, there being a rotary switch 55 in lieu of the 5 slide switch 49. A rotary element 56 mounted on the printed circuit board 20" in the center of this printed circuit board is connected via a connecting conductor 57 with the contact face 47 in a suitable manner. A wiper contact 58 on this rotary element 56 sweeps the individual wires of the printed wiring 23" when 10 rotation takes place. Adjacent to this rotary element 56 the printed wiring extends generally radially. It is in this manner that a greater variety of switching combinations are produced, as was indicated in the embodiment shown in figure 5.

Figure 7 shows the electrical connection together of five 15 valve units in a schematic. As was the case with the other embodiments already described, in this case as well the printed circuit boards 20' (or 20") connected in series via the plug connection devices 21 and 22 have ten switching wires of the printed wiring 23' (or 23"), and there is in addition the wiring 20 continuously connected with the power supply. The electromagnet windings 13 of the actuating blocks 11 and, respectively, 12 on the one hand always connected with the positive supply conductor and, respectively, with the corresponding printed wiring, whereas the second terminal is able to be connected via the slide switch 25 49 (or, respectively, the rotary switch 55) selectively with one of the other wires of the printed wiring.

If a valve unit as in figure 1 has two actuating blocks 11 and 12, as for instance for an pulse valve, the corresponding electromagnet windings may be put in parallel. It is however also 30 possible to put such electromagnetic valve windings separately in circuit using a double slide switch.

The connecting conductors 46, 50 and 57 shown in figures 4 through 6 may obviously also be in the form of printed wiring if it is suitably set out, or they may be in the form of printed

wiring on the back side.

It is naturally possible to have other similar blocks in place of connection blocks for the connection of fluid power units by way of the connecting means as described.

Claims

1 A fluid power valve unit comprising

- a valve block which bears at least one electromagnetic actuating block and is adapted for connection with a connection block having fluid power ducts, said connection block having means for connection with further connection blocks
- electrical power supply and/or control lines extending in the connection block,
- plug connection devices connected with these lines arranged on those sides of the connection block which on connection with further connection blocks come into engagement with corresponding sides thereof
- and electrical connecting means for the lines in the connection block, said electrical connecting means including electrical terminals of the at least one actuating block.

2 A valve unit as claimed in claim 1, wherein said connecting means are especially in the form of printed wires on a printed circuit board, in the case of which two opposite side edges are arranged to bear and/or constitute plug connection devices.

3 A valve unit as claimed in claim 2, wherein one such plug connection device is designed in the form of a multiple male plug connector and another one thereof is in the form of a female plug connector.

4 A valve unit as claimed in claim 3, wherein the multiple male plug connector extends from the connection block.

5 A valve unit as claimed in claim 3 or in claim 4, wherein

the multiple male plug connector is formed by sections of printed wiring.

6 A valve unit as claimed in any one of the claims 2 through 5, wherein said printed circuit board is accommodated in a through passage in the connection block.

7 A valve unit as claimed in any one of the claims 2 through 6, wherein said printed circuit board has control terminal contacts for the electrical contact means for use with the actuating block, at least two of such wires being connected or adapted to be connected with the control terminals.

8 A valve unit as claimed in claim 7, wherein the contact means of the plug connector devices are arranged in a juxtaposed manner along side edges of the printed circuit board and one of such contact means is connected for transmission of the potential of one power supply pole with directly opposite contact means and with one of such control terminal contact means, whereas the remaining contact means are connected with oppositely placed contact means with an offset of one contact means in each case, and one of two outer contact means is connected without such a connection with a second one of such control terminal contact means.

9 A valve unit as claimed in claim 7, wherein the contact means are arranged along side edges of the printed circuit board in a juxtaposed manner, the contact means on one side edge are connected with correspondingly arranged contact means on the other side edge via the printed wires, one of the printed wires is connected with one of the said control terminal contact means for the transmission of the potential of one of the power supply poles and at least a second one of the control terminal contact means is connected via a multi-way switch device with a respective one of

the printed wires.

10 A valve unit as claimed in claim 9 wherein the multi-way switch device is in the form of a linear slide switch or rotary switch.

11 A valve unit as claimed in claim 10, comprising a housing having an opening therein for access to the said switch device.

12 A valve unit as claimed in claim 1, wherein said means for connection with further blocks comprise electrical connection devices for connection with electrical terminals of the actuating block and designed in the form of a printed circuit board.

13 A valve unit as claimed in claim 12, wherein said printed circuit board is arranged between the valve block and said connection block and comprises a part projecting at least as far as the terminal contact means of the at least one actuating block.

14 A valve unit as claimed in claim 12 or in claim 13, wherein connection conductors, preferably in the form of printed wires on the printed circuit board, are connected with a plug connector device projecting towards the connection block and wherein the male plug connection device inserted into a corresponding recess in the connection block is adapted to be able to be pluggingly connected with another such printed circuit board.

15 A valve unit as claimed in claim 13 or in claim 14, wherein the projecting part has plug connection devices adapted to be pluggingly connected with the terminals, designed in the form of plug connection devices, on the actuating block.

16 A valve unit as claimed in claim 15, wherein the plug connection devices on the actuating block are designed in the form of male plug contact means adapted to fit into such printed circuit board and the plug connection means on the printed circuit board are constituted by suitably shaped contact openings.

17 A valve unit as claimed in claim 15 or in claim 16, wherein the plug connection means on the printed circuit board are surrounded by a sealing element inserted into the printed circuit board, such sealing element preferably being in the form of an elastomer.

18 A valve unit as claimed in any one of the claims 12 through 17, wherein said printed circuit board includes light producing elements for indicating switching states or the voltage state of the actuating block.

19 A valve unit as claimed in claim 18, wherein said light producing elements are arranged on outer end parts of the printed circuit board.

20 A valve unit as claimed in any one of the preceding claims, wherein, of the two opposite sides, of each connection block, which are able to be engaged with corresponding sides of further connection blocks, the one side is provided with projecting retainer elements having a retainer head and the other side has openings to receive corresponding retainer elements of a further connection block, the openings coming to an end at rotary elements set in the connection block, such rotary elements being provided with a rotary wedge or keyfor fixing an inserted retainer head on rotation of the rotary element.

21 A valve unit as claimed in claim 20, wherein the retainer elements are adapted to be screwed into the connection

block.

22 A valve unit as claimed in claim 20 or in claim 21, wherein the rotary elements are adapted to be inserted into corresponding recesses in the said connection block which are arranged to be perpendicular to the openings and wherein the outer side of the inserted rotary elements extends to be substantially aligned with the outer face of the connection block.

23 A valve unit as claimed in any one of the claims 20 through 22, wherein the outer face of the rotary elements is adapted for engagement by a tool for turning it.

24 A valve unit substantially as described above with reference to Figs. 1 to 4 of the accompanying drawings.

25 A valve unit substantially as described above with reference to Figs. 1 to 3 and Fig. 5 of the accompanying drawings.

26 A valve unit substantially as described above with reference to Figs. 1 to 3 and Fig. 6 of the accompanying drawings.

27 Any novel subject matter or combination including novel subject matter disclosed in the foregoing Specification or Claims and/or shown in the drawings, whether or not within the scope of or relating to the same invention as any of the preceding Claims.